

Open Research Online

The Open University's repository of research publications and other research outputs

Dorsal root ganglion neurons maintained in a 3D culture model exhibit similar electrophysiological properties to fresh explants

Conference or Workshop Item

How to cite:

East, E.; Murphy, K. and Phillips, J. (2011). Dorsal root ganglion neurons maintained in a 3D culture model exhibit similar electrophysiological properties to fresh explants. In: Tissue and Cell Engineering Society, 19-21 Jul 2011, Leeds.

For guidance on citations see [FAQs](#).

© 2011 The Authors

Version: Version of Record

Link(s) to article on publisher's website:

<http://www.ecmjournal.org/journal/supplements/vol022supp03/pdf/Vol22supp03a56.pdf>

Copyright and Moral Rights for the articles on this site are retained by the individual authors and/or other copyright owners. For more information on Open Research Online's data [policy](#) on reuse of materials please consult the policies page.

oro.open.ac.uk

Dorsal root ganglion neurons maintained in a 3D culture model exhibit similar electrophysiological properties to fresh explants.

E. East, K. P. S. J. Murphy & J. B. Phillips

Department of Life Sciences, The Open University, Milton Keynes, UK

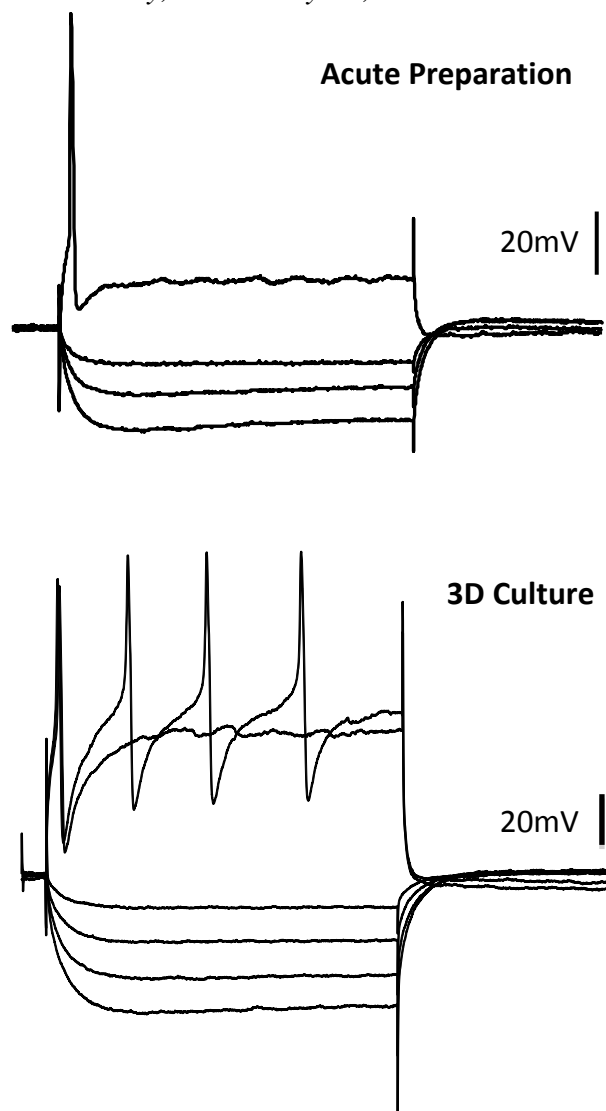
INTRODUCTION: Tissue engineered culture models provide a powerful tool for neuroscience research¹. They overcome limitations associated with monolayer cultures of neurons and glia by maintaining cells in a more realistic 3D spatial arrangement, and permit continuous monitoring and control of variables that cannot be achieved in animal models. Here we report the development of a system for recording electrophysiological behaviour in neurons in 3D culture.

METHODS: Dorsal root ganglia (DRGs) were harvested from adult rats, dissociated using collagenase, then seeded within 2 mg/ml Type I collagen gels and maintained in culture for 20 hours. Preparations were transferred to an interface recording chamber at 29 °C, perfused with culture medium at 150 μ l/min and exposed to warmed and humidified oxygen (95 %) and carbon dioxide (5 %). Recordings were made using glass micropipettes filled with 3M KCl (electrode series resistance 60-80 MOhms) attached to an Axoclamp 2B amplifier and stored on a Macintosh computer. Neurons in 3D culture were compared to those in acutely hemi-sectioned DRG explants.

RESULTS: Resting membrane potential and input resistance were recorded from neurons in both 3D cultures and acutely hemi-sectioned control tissue. Characteristic membrane voltage responses to hyperpolarising current were obtained and injection of depolarising current elicited action potentials (Fig 1).

Fig 1: Upper Panel: traces recorded from a cell in an acutely hemi-sectioned DRG. The neuron had a membrane potential of -81 mV and input resistance of 110 MOhms. Traces show the membrane voltage responses to injections of hyperpolarising current (-0.1, -0.2 and -0.3 nA; 150 ms duration) and a depolarising current sufficient to elicit an action potential.

Lower panel: traces recorded from a DRG neuron in 3D culture. The neuron had a membrane potential of -87 mV and input resistance of 68 MOhms. Traces show the membrane voltage responses to injections of hyperpolarising current (-0.2, -0.4, -0.6 and -0.8 nA; 150 ms duration) and injections of depolarising current that elicited



either a single action potential or a train of action potentials.

DISCUSSION & CONCLUSIONS: Adult rat DRG neurons maintained in 3D culture exhibit electrophysiological responses comparable to their counterparts in fresh tissue explants. This system provides a functional model in which neuronal responses can be monitored. The reproducibility and control make this approach suitable for further development as a model for toxicity testing.

REFERENCES: ¹ E. East & J.B. Phillips (2008) Tissue engineered cell culture models for nervous system research in *Tissue Engineering Research Trends* (ed G. N. Greco) Nova Science Publishers.